Projections of Brazilian Agriculture: 1985-95

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Abstract: The main purpose of this study is to provide the Brazilian Government with quantified projections of country demand for, production of, and trade in important agricultural commodities. Under current conditions, Brazil will have to import massive amounts of food in the next decade. The objective of satisfying internal demand can be met by increasing yields and removal of restrictive policies. The results point to the continuation of low levels of per capita consumption. Policy makers must therefore turn to ways of improving the producer's expectation of better relative price conditions, maintain a realistic foreign exchange rate, and take measures to subsidize food for the low income population. The idea of doubling food production by 1995 to allow the country to be free of the risk limit of food scarcity and the dependence on foreign markets also requires the transformation of traditional farming methods through the use of higher yielding technologies. Agricultural research and extension will play an important role in the modernization process. Heavy investment will also be necessary for irrigating crop land and the incorporation of new land areas.

Introduction

The crisis started in 1973 by OPEC's decision to raise international petroleum prices brought a variety of consequences for the oil-importing countries. The decision was particularly harmful to Brazil, which was then producing only about 20 percent of its petroleum needs. Despite the development of alternative energy sources, the share of petroleum imports relative to Brazil's total import bill has increased. The country's second largest import is wheat, and Brazil depends heavily on imports to supply its internal demand. Furthermore, importing capital goods cannot be cut severely without harming the development process. Because not much can be done to curtail imports, the alternative way to improve the balance of trade is by increasing exports. Agriculture is believed to be the best way to increase exports because of certain characteristics of the sector.

The balance of payments problem faced by Brazil is accompanied by a very high internal rate of inflation with consequent deterioration of the income distribution in a country in which the annual rate of population growth is still around 2.5 percent.

The Problem

Historically, Brazil's agricultural sector has been discriminated against by economic policies aimed at protecting other forms of development, such as industrialization for import substitution and export promotion of manufactured goods. A series of restrictive policies such as export quotas, multiple exchange rates, overvalued exchange rates, and even more complicated methods of licensing and deposit were some of the ways government policies penalized the agricultural sector.

These restrictive policies (directed towards either the external market, internal market, or both) have driven resources out of the agricultural sector. As a consequence, grain production has, since 1977, stagnated at a level below 50 Mt. Since then, the population has increased by more than 20 million, thus diminishing per capita food production and availability. The only increase in the cultivated area was in the case of sugarcane, from 2.0 million ha in 1977 to 3.4 million ha in 1983; in some regions, as in the State of São Paulo, the gain in area was possible only by reduction of the area devoted to other products. The sector grew very rapidly due to different forms of subsidies, followed by massive public investment to stimulate production. Brazil is now producing 840,000 million litres of alcohol—compared with 140,000 million in 1977—to be used as motor fuel.

The demands placed on the agricultural sector are now expected to be very heavy due to the needs for exports and foreign exchange earnings and of the domestic market. The supply of food will have to grow at increasingly faster rates or Brazil will be, in a few years, a steady importer of several agricultural products. This study is an attempt to project into the future a system of several import commodities in which simultaneous interactions between the consumer and farm levels of the market channels are possible. The products considered in this study include maize, rice, wheat, soyabeans, soyabean meal, soyabean oil, beef, pork, and broilers. The products were chosen mainly because of their importance in the domestic economy and because they are interrelated, competing for the same area, substituting in consumption, or both. No mention is made of other important agricultural products, such as coffee and sugarcane, in order to keep the model manageable and because interest was mainly concentrated in the grain-livestock sector.

Overview of the Modelling Approach

The objective of this study was to build an econometric model for the grain and livestock sectors to be used for prediction and policy simulation. The basic conceptual approach to the model was similar for each commodity. Functional relationships were estimated for domestic disappearance (including food and industrial use, feed, and seed), carryover stocks, production, and domestic price determination. The demand for exports was considered a residual. The role of government intervention in determining domestic agricultural prices was included as a set of price relationships relating domestic prices to world prices and exchange rates. The price relationships included other economic variables assumed to influence the government's decision to intervene in domestic prices.

The most important components of the economic model of Brazil's grain-livestock subsystem are producers, domestic consumers, the government, and foreign consumers. Because of the recursive and simultaneous nature of the system, a change in one of the submodels can affect the whole system. An increase in the beef cattle price, for example, can affect the other livestock products and can even show effects beyond the sector. Direct and indirect effects can be observed in the pig, poultry, maize, and soyabean submodels. A change in the price of beef cattle affects the soyabean acreage through changes in the area devoted to grazing. A change in the price of soyabeans affects the demand for Brazilian soyabeans. The domestic soyabean meal demand is mainly determined by the demand for broiler feed, and demand for soyabean oil is largely determined by the demand for cooking oil. The volume of soyabeans and products to be exported is determined mainly by the difference between the respective supply and demand. The same soyabean price determines the relative profitability of soyabeans, which in turn affects the decision to cultivate soyabeans and competitive crops the following year when interaction of the total demand for and supply of soyabeans and government intervention produces a new market price.

The submodels for the other commodities follow a similar pattern. Additional interactions are generated in the system as the continuous effects of changes in other sectors occur. The interaction and feedback effects among the products considered are represented by the underlying recursive and simultaneous equations of the model. The submodels were simulated simultaneously over the historical period. Actual lagged values were used to force the model to correct itself. Interactions among the submodels were thus permitted.

The model was simulated over the 1985-95 period under different scenarios. A baseline projection was obtained by letting the model feed itself, using estimated lagged values. The forecasts from that scenario were then compared with those from alternative scenarios under different assumed conditions. Some results of those simulations are presented in the next section. The simulations described in this study were carried out using the GSIM program developed at Michigan State University (1982).[2] GSIM uses the Gauss-Seidel straightforward numerical method to obtain the solution of simultaneous systems of equations.

The full model consists of 48 equations, 37 of which are structural. The remaining 11 equations are technical relationships and identities. Estimation of the econometric equations was based on annual time series data covering 1961-82, the most representative period to reflect the current structure of production, consumption, and trade in Brazil.[3]

Simulation Results

The projections for 1985-95 are just an indication of the direction in which production, consumption, and trade will move; we do not attempt to predict their exact volumes. A projection in which only some exogenous variables are allowed to change, *ceteris paribus*, cannot represent a real world that is very dynamic in nature, and 10 years is long enough to permit unexpected changes. The first variation that can be anticipated for a country like Brazil, which needs drastically to increase its agricultural production, is change in technology. The model permits an increase in productivity only along the same path in which it occurred in the historical period and only when representing the increase by the underlying production equations is possible.

The basic scenario was designed to show the expected gradual development of the endogenous variables if the historical relationship continues into the future. To generate the baseline forecasts, some of the exogenous variables were projected on the basis of conservative measures. Population was assumed to grow at 2.2 percent per year and the per capita income variable was allowed to increase at 2.0 percent per year during 1985-90 and at 3.5 percent per year during 1991-95. Other

Table 1—Projection Results under Baseline (B) and Alternative (A) Scenarios*

	1985 (B)	1985 (A)	1990 (B)	1990 (A)	1995 (B)	1995 (A)
Maize						
Area (million ha)	11.4	11.6	12.4	13.6	13.0	15.3
Production (Mt)	20.5	21.1	22.3	27.4	23.3	34.1
Demand (Mt)	18.9	18.8	25.4	25.2	31.9	31.7
Net trade (Mt)	0.40	1.18	-4.41	0.55	-10.0	0.39
Rice						
Area (million ha)	6.30	6.33	7.50	7.61	8.44	8.61
Production (Mt)	9.32	9.51	11.1	12.3	12.5	15.0
Consumer demand (kg/capita)	46.6	46.3	45.9	45.8	44.1	44.3
Net trade (Mt)	-0.87	-0.71	-0.47	0.28	-0.16	1.35
Wheat						
Area (million ha)	1.90	2.02	2.60	3.07	3.54	4.30
Production (Mt)	1.81	1.97	2.47	3.38	3.37	5.36
Consumer demand (kg/capita)†	37.9	37.8	38.4	37.7	39.1	37.8
Net trade (Mt)	-5.25	-5.24	-5.86	-5.04	-6.13	-4.19
Soyabeans						
Area (million ha)	9.24	9.33	11.6	11.8	13.9	14.3
Production (Mt)	15.9	16.2	19.9	21.6	23.8	27.4
Crush demand (Mt)	12.7	12.8	15.6	16.2	18.4	19.8
Net trade (Mt)	1.49	1.64	2.12	3.12	2.79	4.85
Soyabean Meal						
Production (Mt)	9.85	9.94	12.1	12.6	14.3	15.3
Feed demand (Mt)	4.17	4.12	5.07	5.02	5.96	5.91
Net trade (Mt)	5.66	5.80	7.00	7.55	8.34	9.40
Soyabean Oil						
Production (Mt)	2.35	2.37	2.89	3.00	3.42	3.66
Consumer demand (kg/capita)	12.3	12.3	14.8	15.1	17.7	18.5
Net trade (Mt)	0.68	0.70	0.66	0.72	0.45	0.56
Beef						
Production (Mt)	2.40	2.34	2.44	2.53	2.45	2.64
Consumer demand (kg/capita)	17.2	16.4	17.4	16.7	18.2	17.5
Net trade (Mt)	0.09	0.14	-0.17	0.03	-0.59	-0.27
Pigmeat						
Production (Mt)	0.97	0.97	1.02	0.99	1.05	1.01
Consumer demand (kg/capita)	6.00	6.00	6.00	6.00	6.00	6.00
Net trade (Mt)	0.17	0.16	0.12	0.09	0.05	0.01
Broilers						
Production (Mt)	1.66	1.64	2.02	2.01	2.39	2.38
Consumer demand (kg/capita)	5.34	5.32	6.14	6.12	7.51	7.49
Net trade (Mt)	0.94	0.93	1.10	1.10	1.14	1.13

[*Due to space limitations, only three years are presented. †Wheat-flour.]

exogenous variables were assumed to remain constant at their 1984 level throughout the projected period. The yields for the four crops have stabilized in recent years; they were therefore assumed to remain constant at their average 1981-84 level during the projection period.

The above assumptions were used to run the model. The results (see Table 1) were used as a basis for comparison with projections derived from alternative scenarios. The results indicate that production will not grow enough to meet projected demand. Brazil, under such conditions, will have to import significant amounts of maize, rice, wheat, and beef. Several alternative simulation runs were made with possible gains in yields of each crop, removal of government intervention in the domestic prices through the overvalued exchange rate, and other restrictive policies. For reasons of space, only the results of one alternative scenario are reported in this paper.

Changes in the levels of yield alone were not sufficient to get satisfactory results; they had to be combined with tax limitations to ensure incentive prices to producers and adequate revenues to purchase yield-increasing inputs and to leave some economic rent in the agricultural sector. An average 10 percent increase in prices was used as a proxy to a possible removal of several restrictive policies that have penalized the agricultural sector. The results under that alternative scenario (reported in Table 1 on page 49) were possible under the following rates of change in the yields, expressed on an annual basis: 2.2 percent for maize, 1.5 percent for rice, 2.5 percent for wheat, and 1.0 percent for soyabeans.

The assumptions made in the alternative scenario resulted in the prediction that, in 1995, more food will be produced than in the baseline scenario because the model assumes that farmers respond to expected crop yields as well as to expected prices. Trade conditions in general would be improved. The most important consequences are the elimination of the maize deficit and the reduction in the projected import level of wheat. In both scenarios, the model took into consideration the government's removal of the consumer subsidy for wheat. Higher retail prices of wheat flour would decrease the per capita consumption and consequently reduce imports.

Conclusions

The main purpose of this study was to provide the Brazilian Government with projections of country demand for, production of, and trade in important agricultural commodities. With no change in current conditions, Brazil would have to import massive amounts of food in the next decade, but internal demand could be met by increasing yields and removal of restrictive policies. The results point to the continuation of low levels of per capita consumption. Policy makers must therefore turn to ways of improving the producers' expectations of better relative price conditions, maintaining a realistic foreign exchange rate, and taking measures to subsidize food for the low income population. The idea of doubling food production by 1995 in order to allow the country to be free of the risk of food scarcity and dependence on foreign markets also requires the transformation of traditional farming methods through higher yielding technologies. Agricultural research and extension will play an important role in the modernization process. Heavy investment will also be necessary for irrigated crop land and the opening of new area to cultivation.

Notes

[1]Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA).

[2]Based on the general analytical simulation solution program (GASSP), originally developed at the US Department of Agriculture.

[3]Due to space limitations, the survey method and estimation procedures of the model are not discussed here (see Crocomo, 1982).

References

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